

Remarks/Arguments

Reconsideration of this application is requested.

RCE and Extension of Time

Requests for continued examination (RCE) and a one month extension of time are enclosed in response to the final Office Action mailed on April 29, 2008. The extended period for response expires on August 29, 2008.

Specification

The title is objected to as not descriptive. In response, the title is amended to "Method for Manufacturing Micro Lenses including Underlayer Film and Lens Film Etching Steps", which is clearly indicative of the invention to which the claims are directed.

Claim Status

Claims 1-10 are pending. Claims 1-4 and 8-10 are withdrawn from consideration as drawn to a non-elected species. Claim 5 is amended.

Claim Rejections – 35 USC 103

Claims 5-7 are rejected under 35 USC 103(a) as obvious over Suzuki (JP 9-27608) in view of Sano (US 6,030,852). In response, applicant traverses the rejections.

In the etching step of the present invention, concave regions are formed in the lens film over the convex regions of the underlayer film by applying a resist over the lens film that reflects the shape of the underlayer film to flatten the surface of the lens film and applying an etching process under a condition that the lens film is more easily etched than the resist.

As shown in applicant's FIGS. 10-12 and described at page 15, lines 14-27, for example, the surface of lens film 23 is rendered flat by applying a resist 33 over lens film 23 (FIG. 10). The surface of resist 33 is then etched back under a condition that lens film 23 undergoes etching more easily than resist 33. Consequently, exposed parts of lens film 23 are etched to a greater degree than resist 33 (FIG. 11). As a result, concave regions are formed in lens film 23 (FIG. 12).

Thus, through the etching step, concave regions are formed in the lens film over the convex regions of the underlayer film 22 through self-alignment. As shown in FIG. 14, it is thereby possible to form the concave regions over the convex regions of the underlayer (insulating) film 22 without a complicated positioning effort and to form a micro lens having a convex shape protruding toward the top. In addition, a micro lens having convex shapes protruding both toward the top and the bottom as shown in FIG. 12 can be formed without a complicated positioning effort.

Independent claim 5 is amended as follows to clarify the etching step:

...an etching step for forming concave regions in the lens film over the convex regions by applying a resist over the lens film to flatten the surface of the lens film and applying an etching process under a condition that the lens film is more easily etched than the resist...

Sano discloses a method for forming a concave region by a second micro lens 2 on a convex region of a solid-state imaging device. However, the concave region formed by second micro lens 2 is not formed through an etch-back process of an element surface protecting layer 5 laminated and reflecting the shape of BPSG film 6. With respect to Suzuki, because the surface of transparent flattening layer 13 is flat, even if a concave region is formed in transparent flattening layer 13 over the convex region of concave lens 12 according to Sano, the region cannot be formed through self-alignment, unlike the present invention.

Since Suzuki and Sano do not disclose or suggest each and every feature of claim 5, claim 5 and claims 6 and 7 dependent thereon are not obvious over Suzuki in view of Sano. The rejections of claims 5-7 under 35 USC 103(a) should therefore be withdrawn.

Conclusion

This application is now in condition for allowance. The Examiner is invited to contact the undersigned to resolve any issues that remain after consideration and entry of this amendment.

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Amdt. dated August 29, 2008
Reply to Office Action of April 29, 2008

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Any fees due with this response may be charged to our Deposit Account No.
50-1314.

Respectfully submitted,
HOGAN & HARTSON L.L.P.

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By: 

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